

Formulation and Evaluation of Face Serum

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ABSTRACT

Facial wrinkles and skin aging are common effects of photo damage caused by ultraviolet (UV) radiation. At present, there are limited effective methods to slow down the skin aging process. A face serum containing Aloe Vera, glycerin, and honeybee venom is a potent cosmetic formulation. Aloe Vera offers not only immediate cosmetic improvements but also a sense of psychological well-being. The serum is known for its fast absorption and ability to reach deeper layers of the skin. Aloe Vera gel is widely used for treating various skin conditions such as sunburn, minor wounds, insect bites, and also possesses wound-healing, anti-inflammatory, antibacterial, and antifungal properties. Bee venom, a natural toxin produced by bees, is known to promote blood circulation and stimulate collagen synthesis. The face serum underwent evaluation for physical and chemical properties, including pH, globule size, and consistency. Stability testing confirmed no significant changes in appearance, uniformity, or globule size over time.

Keywords: A Loe Vera, Olive Oil, Coconut Oil, Glycerin, Moisturizer, Toner, Anti-Aging, Natural Skincare

INTRODUCTION

The study of human skin plays a vital role in the fields of dermatology, toxicology, pharmacology, and cosmetology. It helps evaluate how external substances affect the skin, including their interactions, absorption mechanisms, and potential toxicity to different skin layers. Human interest in beauty dates back to prehistoric times, reflecting a long-standing desire to appear attractive and healthy. The term "cosmetic" originates from the Greek word meaning "to adorn" or enhance appearance.

Cosmetology involves the study and practice of beauty treatments. It encompasses the art and science of improving the appearance of the skin, hair, and nails, as well as the use and formulation of cosmetic products. For a skincare product to be effective, it must deliver active ingredients deep into the skin. Face serums are specifically designed for this purpose, offering a safer alternative to harmful chemicals by providing long-term results. Serums are highly concentrated formulations commonly used in professional cosmetology. Although similar in water or oil content to creams, serums contain significantly higher concentrations of active ingredients—up to ten times more than creams—making them more effective. Face serum is a potent skincare product available in both water-based and oil-based formulations. Compared to creams, serums are highly concentrated—typically containing around ten times more active ingredients—making them more effective in treating various skin concerns. When used consistently as part of a daily skincare routine, just a few drops of serum can produce noticeable improvements within a month, thanks to its small molecular structure that allows for deep and rapid skin penetration.

Serums are rich in beneficial components such as antioxidants, ceramides, amino acids, and other nutrients. This high concentration of powerful ingredients explains why serums are often the most expensive item in a skincare regimen. Whether it's a moisturizer, anti-aging, or anti-wrinkle product, all should ideally include antioxidants, cell-communicating elements, and skin-identical ingredients—crucial for maintaining healthy skin across all types.

Product texture should be chosen based on skin type: gels and liquids are ideal for oily and combination skin, lightweight serums and lotions suit normal to dry skin, and thicker lotions or creams work best for very dry skin. Regardless of personal preference or product texture, the essential ingredients for skin health remain the same for everyone. The skin, being the body's largest organ, constantly works to repair and protect itself.

However, external factors like UV exposure, pollutants, and residual makeup can lead to dryness and irritation. Facial serums often contain ingredients that target fine lines, wrinkles, and enhance skin barrier function. These include neuropeptides like AP-8, which influence muscle contractions, and beta-glucan, known for promoting cell renewal and supporting immune defense. Other common components are sodium hyaluronate for hydration, vitamins C and E for antioxidant protection, and green tea extract rich in polyphenols. What sets serums apart from creams and lotions is what they lack—specifically, fewer thickening or lubricating agents like nut or seed oils. Most serums are water-based and formulated without oils, allowing them to deliver concentrated benefits without heavy or greasy residue.



Ideal Qualities Of Face Serum:

1.Calms Irritated Skin:

Aloe vera is known for its antiviral properties and ability to promote cell regeneration. Applying aloe gel provides relief similar to the soothing effect it has on sunburned skin.

2.Intense Hydration:

It has a unique ability to both boost and regulate skin moisture levels.

3.Combats Acne and Reduces Blemishes:

Bael fruit helps prevent the bacterial growth responsible for acne and pimples.

4.Reduces Dark Circles and Puffiness:

Rich in Vitamin E and antioxidants, it helps lighten eyelid discoloration, while its cooling effect reduces puffiness. It also exfoliates dead skin cells, promoting collagen production and diminishing under-eye circles.

5.Promotes Radiant Skin:

Its antioxidant properties support a healthy and glowing complexion.

Advantages:

- Improves skin texture.
- Minimizes the skin pores.
- Hydration of skin and nourishes the skin.
- Improves skin elasticity

Disadvantages:

- The lightweight, gel-like consistency of serums may not be suitable for individuals with chronic skin conditions such as eczema or rosacea, which compromise the skin's protective barrier.
- In such cases, serums can absorb too rapidly, potentially leading to irritation.

FORMULATION OF FACE SERUM:

When developing a face serum, its physical properties and overall stability are key indicators of quality. A typical face serum is an emulsion composed of two immiscible liquids. To maintain the stability of this emulsion, emulsifiers and thickeners are incorporated. Emulsifiers help stabilize the formulation by reducing the interfacial tension between the two immiscible liquids and preventing the dispersed phase from merging. Thickeners, on the other hand, serve as rheology modifiers, enhancing the viscosity and flow behavior of the emulsion. Another crucial chemical parameter in serum formulation is the pH value. Disrupting the skin's natural pH can interfere with its microbial balance and function, potentially leading to issues like acne, flakiness, overproduction of sebum, and other dermatological problems. The skin's natural flora thrives at a pH between 4 and 4.5, while alkaline conditions (pH 8 to 9) can destroy this beneficial microflora. Maintaining an appropriate pH in the serum helps support and improve the skin barrier. Formulating a serum can be complex, particularly when using the traditional "One Factor at a Time" (OFAT) approach, which involves changing one variable while keeping others constant. This method is time-consuming, costly, and inefficient. Alternatively, employing software like Design Expert and using a D-optimal design allows for more effective optimization, reducing time, labor, and expenses. Creating a stable serum also requires careful blending of the water and oil phases, which are naturally thermodynamically unstable. Emulsifiers are essential in reducing the interfacial tension between these phases, promoting a more stable and long-lasting product.

Ingredient used in face serum:

1) Aloe Vera:

Kingdom : Plantae

Order : Asparagales

Family : Asphodelaceae

Subfamily : Asphodeloideae

Genus : Aloe

Species : Aloe vera

Botanical name : Aloe barbadensis miller •English : India aloe

Aloe Vera has been used to treat wounds and infections. Aloe Vera is now recognised as a crucial ingredient in makeup thanks to advancements in beauty. It has nearly 20 amino acids, enough amounts of nutrients like calcium, magnesium, and sodium, enzymes, vitamins, and Its polysaccharides, nitrogen, and other ingredients make it a wonder plant for attractiveness. Here is a short explanation of some of the most significant uses of aloe Vera for cosmetic purposes.



Fig 1. Aloe Vera

2.Olive oil:

Olive oil is a natural oil extracted from the fruit of the olive tree (*Olea europaea*), primarily grown in Mediterranean countries.

- Rich in Monounsaturated Fats: Especially oleic acid, which is heart-healthy
- Antioxidant Properties: Contains vitamin E and polyphenols
- Anti-Inflammatory Effects: May reduce chronic inflammation
- Supports Heart Health: May help lower bad cholesterol (LDL)
- May Aid in Weight Control: In moderation, part of a healthy diet



Fig 2: Olive Oil

3.Coconut oil:

Coconut oil is a natural oil extracted from the meat or kernel of mature coconuts harvested from the coconut palm (*Cocos nucifera*). It's widely used in cooking, skincare, and traditional medicine.

- High in Saturated Fat: Mostly medium-chain triglycerides (MCTs), especially lauric acid
- May Boost Energy: MCTs are quickly converted to energy
- Antimicrobial Properties: Lauric acid can kill harmful microorganisms
- Skin & Hair Benefits: Moisturizes, reduces protein loss in hair, soothes dry skin
- Controversial Heart Effects: While it may raise HDL (good cholesterol), it also raises LDL (bad cholesterol); use in moderation



Fig 3. Coconut Oil

4. Glycerin:

Glycerine (also spelled glycerin or glycerol) is a clear, colorless, odorless, and sweet-tasting liquid. It is a humectant, which means it attracts and retains moisture. Glycerine occurs naturally in animal fats and vegetable oils and is also synthesized commercially.

Formulation Table:

Table 1. Composition of face serum

Ingredients (for 30 ml)

Sr.no.	Ingredients	%(w/v)	Working formula (30 ml)
1	Aloe vera gel	50%	15 ml
2	Olive oil	10%	3 ml
3	Coconut oil	10%	3 ml
4	Glycerin	20%	6 ml
5	Distilled water	9.5%	2.8 ml
6	Preservatives (sodium benzoate)	0.5%	0.2 ml

Procedure:

1. Aqueous Phase:

- In a clean beaker, mix Aloe vera gel and distilled water.
- Add glycerin and stir until fully blended.

2. Oil Phase:

- In a separate beaker, mix olive oil and coconut oil.
- Warm slightly if necessary to ensure complete mixing.

3. Combine Phases:

- Slowly add the oil phase into the aqueous phase while continuously stirring.
- Use a homogenizer or hand blender for better emulsification.

4. Add Preservative:

- Add the preservative and mix thoroughly.

5. Packaging:

- Transfer the serum into a dark glass dropper bottle to protect it from light.

4. Evaluation of face serum:

Physical Evaluation :

The Colour and appearance of the formulation was observed visually. The formulation procedure uniform distribution of extracts. This test was confirmed by visual appearance and by touch.

pH Measurement:

A standard buffer solution was used to calibrate the pH meter. Approximately 1 ml of the face serum was accurately measured and dissolved in 50 ml of distilled water. The pH of the resulting solution was then determined. Since skin has a naturally acidic pH, the ideal pH range for a skin serum is between 4.1 and 6.7 and pH found to be 6.4.

Spreadability Test:

A 2-gram sample of the serum was placed on a flat surface. A glass slide was positioned on top and connected to a pan holding a 20-gram weight. The time taken (in seconds) for the upper slide to slide off the surface was recorded as an indicator of the serum's spreadability. And it found to be 5-6 cm.

Microbial Examination of the Product:

In this technique, a mixed microbial culture is diluted directly into tubes containing liquid agar medium, which is maintained at 45°C to ensure even distribution of the microorganisms. The inoculated medium is then poured into sterile petri dishes, allowed to solidify, and incubated for microbial growth. The serial dilution method involves progressively diluting the original culture with sterile water or saline to reduce microbial concentration. For testing, 1 ml of the diluted sample is mixed with 20 ml of liquid nutrient agar at 45°C, shaken thoroughly, poured into a sterile petri plate, left to solidify, and then incubated.

Stability Studies:

The formulation and development of a pharmaceutical product are incomplete without conducting appropriate stability testing to evaluate its physical and chemical stability, ensuring the product's safety. Stability testing is performed following ICH guidelines. A short-term accelerated stability study was conducted over a few months for the prepared

formulation. The samples were stored under various temperature and humidity conditions, including 3–5°C, 25°C with 60% relative humidity, and 40°C ± 2°C with 75% relative humidity.

Cyclical Temperature Test:

This test is conducted without maintaining a constant temperature or humidity. Instead, the temperature is varied cyclically each day, alternating between room temperature and freezing conditions to simulate fluctuations and assess the product's stability under changing environmental conditions.

Viscosity Determination:

Viscosity is an important factor in evaluating topical formulations. Solutions with low viscosity tend to be cleared from the skin more quickly, while overly viscous formulations may cause discomfort or have adverse effects. The viscosity of the face serum was measured and found to be 13,759 Pa·s.

Microbial Examination of the Product :

The formulation was free from microbes as they do not show zone of inhibition, when they got inoculated in the agar.

Observations:

Table 3. Stability Studies

Visual Apperance	White translucent
Phase Seperation	Nil
Homogenicity	Good

Table 4.Cyclic temperature Test

Parameter	Stability
Freezer Temperature	Unstable
Room temperature	Stable

Benefits of Face serum:

Using a face serum offers a range of skin benefits. It helps hydrate the skin, which can reduce the visibility of fine lines and wrinkles, while also improving skin texture and diminishing dark spots. Serums enriched with antioxidants provide protection against environmental damage, making them a worthwhile addition to any skincare routine. Depending on the formula, a serum can smooth, firm, or gently exfoliate the skin.

Consistent use of serum can enhance collagen production, significantly improve skin texture, and leave the skin looking firm, smooth, and revitalized. Vitamin C, in particular, plays a key role in skin renewal. Serums with high concentrations of plant-based ingredients are effective in fading dark spots, acne scars, and blemishes.

Moreover, using serums regularly can reduce the need for harsh chemical treatments, which often make the skin more vulnerable to sun damage.

1. Deep Hydration: Serums deliver intense moisture to the skin, helping to keep it soft and supple.
2. Reduces Fine Lines & Wrinkles: Ingredients like hyaluronic acid and peptides help smooth out signs of aging.
3. Improves Skin Texture: Regular use can make the skin feel smoother and more refined.
4. Brightens Skin Tone: Vitamin C and other brightening agents help fade dark spots and even out the complexion.
5. Boosts Collagen Production: Ingredients such as retinol or peptides stimulate collagen, enhancing skin firmness and elasticity.
6. Protects Against Environmental Damage: Antioxidants in serums help guard against damage from pollution and UV exposure.
7. Lightens Scars and Blemishes: Plant-based extracts and active ingredients can help reduce acne scars and pigmentation.
8. Fast Absorption: Serums are lightweight and absorb quickly, delivering active ingredients deeper into the skin.
9. Customizable for Skin Needs: Serums come in various formulations to target specific concerns like acne, dryness, dullness, or sensitivity.
10. May Reduce the Need for Harsh Treatments: Regular use can help avoid more aggressive options like chemical peels.

How to properly apply face serum:

1. Cleanse Your Face: Start with a clean face. Use a gentle cleanser to remove dirt, oil, and makeup.
2. Tone (Optional): Apply a toner to balance your skin's pH and prepare it to absorb the serum more effectively.

3. Apply the Serum:

- * Take 2–3 drops of serum using your fingertips.
- * Gently dab it onto your face (forehead, cheeks, nose, chin).
- * Lightly pat and press it into your skin—don't rub harshly.

4. Wait a Few Seconds: Allow the serum to fully absorb into your skin (about 30–60 seconds).

5. Follow with Moisturizer: Seal in the serum with a moisturizer to keep your skin hydrated and lock in the benefits.

6. Use Sunscreen (Morning Routine Only): If applying in the morning, always follow with sunscreen to protect your skin.

Tips:

- * Use serum once or twice daily, depending on your skin type and the product instructions.
- * Always apply it before heavier creams or oils.

CONCLUSION

This report aimed to explore the concept, history, and overall significance of facial serums. It also covered how to choose the right serum and the proper steps for application. With a wide variety of serums now available for different skin types and concerns, it's important for individuals to clearly understand what they need in a product.

When the right formulation is chosen after carefully evaluating key skin issues, noticeable improvements can be achieved. Since skin health plays a vital role in overall well-being, maintaining a consistent skincare routine with the right serum can help combat signs of aging and protect the skin from damage. Serums, when used alongside a suitable moisturizer and sunscreen, can effectively reduce fine lines, wrinkles, dark spots, and other blemishes.

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